

A REDESCRIPTION OF THE FLEA GENUS *LIBYASTUS* JORDAN, 1936, WITH THE DESCRIPTION OF A NEW SPECIES (CERATOPHYLLIDAE: CERATOPHYLLINAE).

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The genus *Libyastus* Jordan contains ten described species whose normal hosts are African tree squirrels of the genera *Paraxerus*, *Heliosciurus*, *Aethosciurus* and *Funisciurus*. *Libyastus* is most closely allied to the holarctic genus *Tarsopsylla* Wagner, 1927, which also infests tree squirrels. Comparison of a new species of *Libyastus* in the United States National Museum collections (described later in this paper) with material from the Museum of Comparative Zoology at Harvard College, Cambridge, Massachusetts, and the British Museum (Natural History) makes possible a more detailed generic description than that originally given by Dr. Jordan, a description of the type of aedeagus found in *Libyastus*, and short redescriptions of females of the species forming Jordan's (1936) "Section A," an arbitrary subdivision of the genus *Libyastus*.

I am grateful to W. L. Brown, Jr., of the Museum of Comparative Zoology, for lending specimens and checking certain collection data for me. F. G. A. M. Smit, of the British Museum (Natural History), again has my sincere thanks for lending specimens, studying species not available to me, reviewing the manuscript, and otherwise giving much of his time and valuable advice.

Libyastus Jordan, 1936

Libyastus Jordan, 1936, Novit. Zool., 40: 89. Type by original designation: *Ceratophyllus infestus* Rothschild, 1908.

Description.—*Head* (fig. 1): Small clypeal tubercle present. Preantennal area with 2 rows of bristles, the first of 1-3 bristles (sometimes these are missing and only a few hairs remain), and the ocular row of 3 bristles, middle one the smallest. Occiput with vertical preapical row, and with or without a median bristle above antennal groove, and with minute hairs scattered along entire length of the groove. Male with very short bristles apically on pedicel of antenna, female usually with at least 1 of these bristles reaching half distance of clava. Female clava notably long, two times as

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long as broad and not expanded in the middle. Labial palpi reaching to about apex of procoxa, rarely a little beyond. *Thorax* (fig. 8): Pleural arch missing (as in *Tarsopsylla*). Lateral metanotal area (L.M.) usually lacking bristles except one small one in *notabilis* (Jordan, 1925) and in occasional abnormal specimens in other species. *Legs*: Profemur, externally, with 0-6 lateral bristles, internally with 0-3 lateral bristles. First (basal) pair and third pair of plantar bristles on segment V of all tarsi shifted a little on to the plantar surface. Male lacking the long, thin lateral bristles on all first tarsal segments which are present in *Tarsopsylla*. Metatarsal segment I not quite as long as segments II-IV inclusive. Metatibia with 8 dorsal notches including apical notch. *Abdomen*: Basal abdominal sternum always with 1 or more lateral bristles in female, usually with at least 1 bristle in male. One or two subdorsal marginal spinelets on each side of terga I-V (occasionally I-IV) in the male and on terga I-IV in the female. *Male*: With 2 antesensilial bristles, upper one the shorter. Eighth tergum lacking the mesal, dorsal spiculose area found in *Tarsopsylla*, and eighth sternum almost lost, reduced to a semimembranous connection between the seventh and ninth sterna (as in *Nosopsyllus*). Fixed process of clasper not especially prominent, with 1 or 2 acetabular bristles. *Aedeagus* (fig. 7): Apodeme (A.E.A.) long and rather narrow, proximal spur (P.S.) present and apical appendage (A.P.A.) present or absent. Penis rods (P.R.) coiled. Median dorsal lobe (M.D.L.) heavily sclerotized dorsally; crochet (CR.) large, crochet peg (PEG) long. Sclerotized inner tube (S.I.T.) with heavy dorsal armature (A.I.T.), band of inner tube missing. *Female* (fig. 17): With 3 antesensilial bristles (in abnormal specimens there may be 2, 4 or 5). Posterior margin of seventh sternum with at least an indication of a sinus or otherwise modified. Eighth tergum on the inner surface with 3-5 short stout spiniform (genital) bristles mesally below anal segment. Spermatheca with cribriform area produced, forming a prominent cone or snout. Anal stylet (A.S.) with 1 apical and 1 long ventro-lateral bristles, plus 1 or 2 minute lateral hairs. Dorsal anal lobe with 1 very long subapical bristle per side; ventral anal lobe with many bristles, none curved or spiniform (though several may be stout) and 2 very long subapical bristles on each side.

Dr. Jordan has divided the species of *Libyastus* into two sections. Section A is characterized by having the median occipital bristle reduced or absent, fixed process of clasper with a sinus in posterior margin, tergum VIII of male with a small ventromarginal lobe on the posterior margin, and female with the snout of the cribriform

area of the spermatheca projecting outwards, not markedly directed ventrad. Section A includes *infestus* (Rothschild, 1908), *piger* (Jordan, 1925), *duratus* (Jordan, 1931), *selindae* de Meillon, 1940, a new species described below, and possibly *schoutedeni* Berteaux, 1947. Section B has a well-developed median occipital bristle, the fixed process of the clasper lacks a sinus in the posterior side, tergum VIII of the male lacks a small ventromarginal lobe on the posterior margin, and the female has the snout of the spermatheca distinctly projecting ventrad. Here belong *stratiotes* (Rothschild, 1905), *consobrinus* (Jordan, 1925), *notabilis* (Jordan, 1925), *vates* Jordan, 1936 and *hopkinsi* Jordan, 1943.

In the past, *selindae* and *duratus* had been treated as subspecies of *infestus*. Without comment Berteaux (1947, Rev. Zool. Bot. Africa, 40: 102) elevated them to full species. He was correct in doing so, since major genitalic and non-genitalic characters, including size differences, separate these species from each other and from *infestus*.

Libyastus smiti n. sp.
(figs. 1, 4, 8, 14, 15, 17)

Type Data.—Holotype female, from *Aethosciurus byatti*, Tanganyika Territory; Nyange, Uluguru Mountains (south of Morogoro) 4 October 1926, A. Loveridge collector. Paratype female *ibid.* but Baglio, Uluguru Mountains, 22 September 1926. Holotype deposited in the collections of the United States National Museum, U.S.N.M. type No. 63515, paratype in the collections of British Museum (Natural History), Tring.

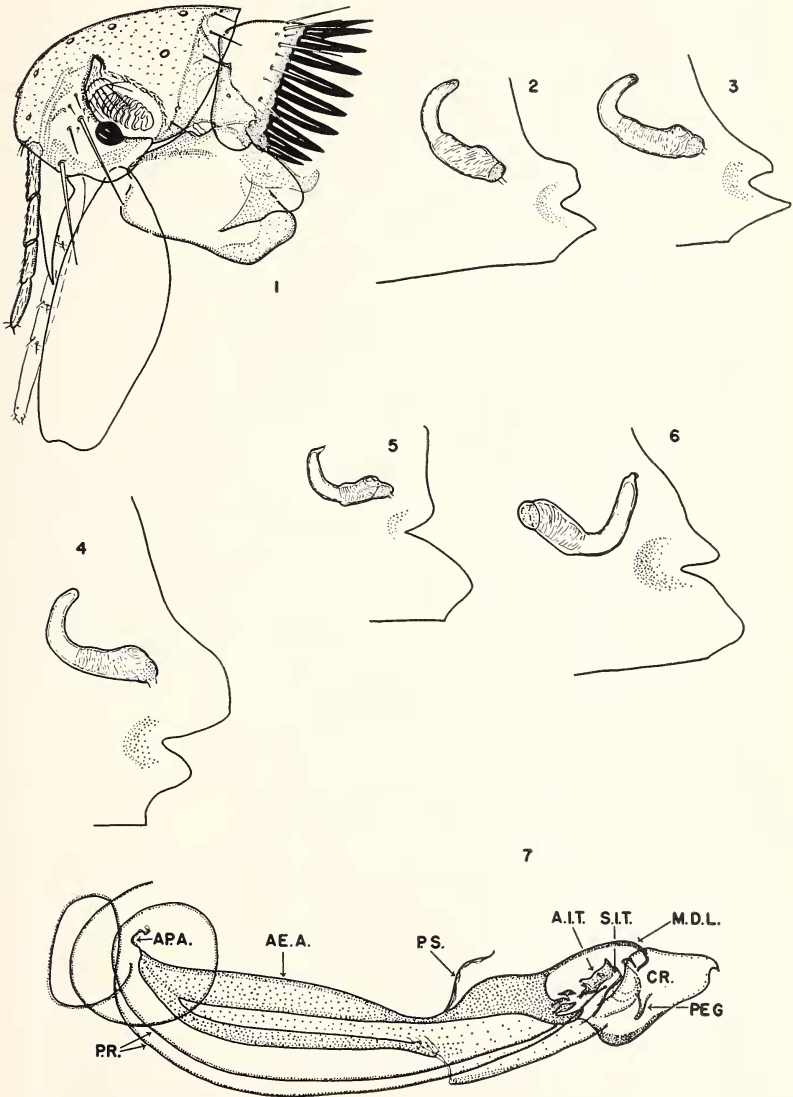
Diagnosis.—A member of Jordan's Section A. Separable from females of all other species in this section by the fact that the upper lobe of the posterior margin of the seventh sternum extends much farther posteriad than does the lower lobe (fig. 4) not with these lobes extending about the same distance, or lower lobe the longer. Closest to *infestus* and *selindae* in shape of the spermatheca. Bulga (body) of spermatheca about same length as hilla (tail), not obviously shorter as in *selindae* and *infestus* (compare figs. 4, 5, 6),

EXPLANATION OF PLATE V

1. *Libyastus smiti*: head, holotype. 2 and 3. *L. duratus*: seventh sternum and spermatheca, paratype female. 4. *L. smiti*: seventh sternum and spermatheca, holotype. 5. *L. infestus*: seventh sternum and spermatheca, female. 6. *L. selindae*: seventh sternum and spermatheca, female. 7. *L. duratus*: aedeagus, male paratype.

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PLATE V



and cribriform area joining bulga at about right angles to ventral margin of bulga. The two apical bristles of eighth tergum set closer together than in either *infestus* or *selindae*, i.e., as close as in *duratus*.

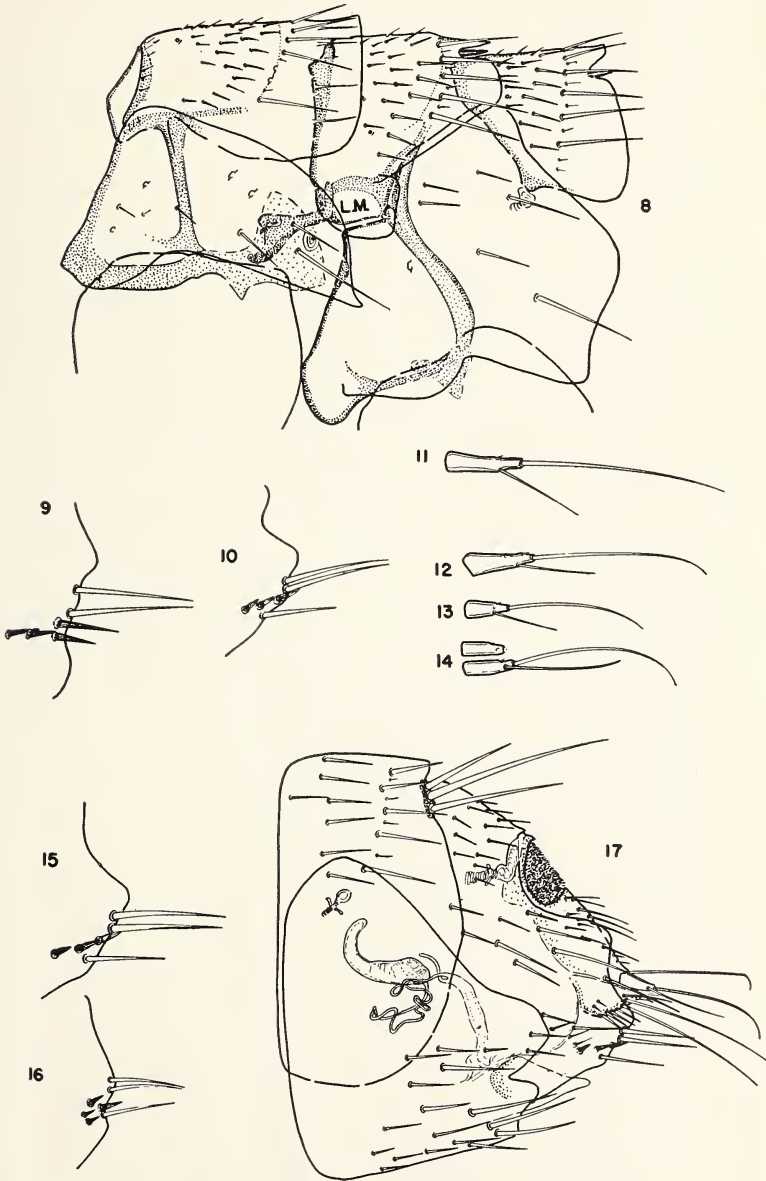
Description.—*Head* (fig. 1): First of two preantennal rows of bristles reduced to one or two short bristles near antennal groove plus a few hairs. Median occipital bristle missing. Remainder of head as normal for the genus. *Thorax* (fig. 8): As in other members of the genus. *Legs*: Profemur with 3 lateral external bristles in holotype, 5 in paratype, and with 1 lateral mesal (internal) bristle. *Abdomen*: Basal abdominal sternum with 12–15 (18–22 in paratype) lateral bristles on a side. *Modified segments* (fig. 17): Two known specimens each possess 3 antesensorial bristles. Above spiracle of tergum VIII, 19–20 small bristles on both sides together. Posterior margin of seventh sternum (fig. 4) with upper lobe large, obtuse, extending much farther posteriad than lower lobe; seventh sternum with about 15 lateral bristles on each side. Eighth tergum (fig. 15) with alveoli of two apical bristles almost touching in holotype, touching in paratype; the 3 or 4 mesal internal short spiniform (genital) bristles set in a row. Spermatheca (fig. 4) with hilla (tail) somewhat shorter than bulga (body), not noticeably humped dorsally; cribriform area joining bulga at approximately right angles to ventral margin of the latter. Anal stylet (fig. 14) of variable length, in holotype one side about $3\frac{1}{2}$ times as long as broad, other side almost 4 times as long as broad, paratype with both sides more than 4 times as long as broad; stylet narrowing only slightly from base to apex.

Length.—Holotype, 4.2 mm.; paratype, 4.8 mm.

EXPLANATION OF PLATE VI

8. *L. smiti*: meso- and metathorax, holotype.

9. *L. selindae*: apex of eighth tergum, paratype female. 10. *L. duratus*: apex of eighth tergum, paratype female. 11. *L. selindae*: anal stylet, paratype female. 12. *L. duratus*: anal stylet, paratype female. 13. *L. infestus*: anal stylet, female. 14. *L. smiti*: anal stylet, both sides, holotype. 15. *L. smiti*: apex of eighth tergum, holotype. 16. *L. infestus*: apex of eighth tergum, female. 17. *L. smiti*: modified segments, holotype. Drawings were taken from specimens as follows: *L. duratus*: paratype male and females from *Aethosciurus byatti*, Modehani. *L. infestus*: female from "squirrel or mouse," Meru. *L. selindae*: paratype female from Chirinda Forest, except the spermatheca drawing, which is from the Mt. Selindae paratype female.



Libyastus duratus (Jordan, 1931)

(figs. 2, 3, 7, 10, 12)

Ceratophyllus infestus duratus Jordan, 1931, Novit. Zool., 37: 144, figs. 1-2.

Libyastus infestus duratus, Jordan, 1936, Novit. Zool., 40: 90. de Meillon, 1940, Proc. Roy. Ent. Soc. Lond. (Ser. B), 9: 146. Hopkins, 1947, Uganda Jour., Sci. Suppl., 11: 153, figs. 75, 83.

Libyastus duratus, Berteaux, 1947, Rev. Zool. Bot. Africa, 40: 102.

L. duratus was described from Tanganyika Territory, Modehani, Ukinga, off *Aethosciurus byatti* [*laetus*], Igale from *Heliosciurus spectabilis shirensis* and Rungwe Mt. from *Cricetomys gambianus viator*, all collected by A. Loveridge. There are in the collection of the Museum of Comparative Zoology the holotype male and three male, three female paratypes from *Aethosciurus byatti*, Modehani, one female paratype from *Cricetomys gambianus viator*, Rungwe Mt., and a fifth female bearing the data "from squirrel no. 2," Rungwe, Tang. Terr., Africa, 22-V-1929, R. Boulton collector. The remaining paratypes from the above-mentioned localities are to be found in the collections of the British Museum (Natural History).

This species is characterized in the female by the shape of the seventh sternum and spermatheca (fig. 2). Seventh sternum outline with upper lobe more narrowly rounded than in *infestus*, lower lobe usually sharply pointed and extending distinctly beyond upper lobe; seventh sternum with 10-16 lateral bristles on a side. The spermatheca with outline of cribriform area like a circle which is flattened on one side at juncture with bulga (body), line of juncture almost at right angles to ventral margin of bulga; a definite dorsal hump on bulga near cribriform area; hilla (tail) about same length as bulga (without cribriform area), not much narrowed except apical third. Anal stylet (fig. 12) $3\frac{1}{2}$ to 4 times as long as broad basally, narrowing to apex. Two long apical bristles on eighth tergum with alveoli touching; the short mesal spiniform (genital) bristles number 3 or 4 and form a straight line (fig. 10).

A large species; females 4.3-4.8 mm., males 3.4-3.7 mm. Male and female profemur with 3-5 lateral bristles on external surface. No medial occipital bristle in either sex. Female with 10-14 lateral bristles on basal abdominal sternum, male with 2-8.

Libyastus infestus (Rothschild, 1908)

(figs. 5, 13, 16)

Ceratophyllus infestus Rothschild, 1908, in Sjöstedt, Kilimandjaro-Meru Exped., II: 4, pl. 1, figs. 6-9. Jordan and Rothschild, 1913, Novit. Zool., 20: 537, figs. 10-11. Jordan, 1925, Novit. Zool., 32: 105.

Ceratophyllus infestus infestus, Jordan, 1931, Novit. Zool., 37: 144.

Libyastus infestus infestus, Jordan, 1936, Novit. Zool., 40: 90.

Hopkins, 1947, Uganda Jour., Sci. Suppl., 11: 153, figs. 74, 82.

Libyastus infestus duratus, Jordan, 1937, Novit. Zool., 40: 288 (err. det.).

Libyastus infestus, Berteaux, 1947, Rev. Zool. Bot. Africa, 40: 102.

L. infestus was described from *Funisciurus ganana* (misdetermination for *Paraxerus ochraceus* ssp., *vide* Hopkins, 1947), Kibonoto, Mount Kilimanjaro, Tanganyika, and has also been reported from *Heliosciurus keniae* from Mount Kenia, central Kenya by Jordan and Rothschild (1913). Three females in the Museum of Comparative Zoology from "squirrel or mouse" (probably from the squirrel), Mt. Mweru, Tanganyika Territory, 21 Aug. 1901, G. Allen collector, have proved to be this species. One of these three females was reported as *infestus duratus* by Jordan (1937). The "Mt. Mweru" referred to in this record is actually Meru, Kenya (not Tanganyika), on the Equator at about 36°30' E. (Information received from W. A. Brown, Jr., who consulted with J. Bequaert and A. Loveridge, both of whom are familiar with Allen's collecting localities in Africa). The "Meru" of Allen should not be confused with the "Mt. Meru" which is the twin of Mt. Kilimanjaro in Kenya, an area where Allen never collected. Three females and one male from *Paraxerus jacksoni capitis*, Nairobi, Kenya, 29 Sept. 1920, W. N. van Someren collector, from the British Museum collections have also been examined.

Infestus females may be separated from other members of Section A by the shape of the posterior margin of the seventh sternum (fig. 5) which has the upper lobe broadly rounded, the sinus small and triangulate and the lower lobe also more broadly rounded than in *duratus* and extending well beyond the upper lobe. There are about 15-20 lateral bristles on each side of the seventh sternum. The spermatheca as in fig. 5; cribriform area not semicircular, juncture with bulga (body) is oblique; bulga humped dorsally just before the cribriform area; hilla (tail) about as long as bulga and gradually narrowing to apex, which has a sclerotized papilla. Anal stylet about 3 times as long as broad basally, narrowing to apex (fig. 13). Eighth tergum with alveoli of the two long apical bris-

gles not touching, and mesal (genital) bristles consisting of 2 large and 2 smaller bristles, not forming a straight line (fig. 16).

A smaller species than most members of Section A; female 3.0–5.0 mm., male 2.8–3.5 mm. Male and female with profemur lacking lateral external bristles. Median occiput bristle absent in female, a small one may be present in male. Basal abdominal sternum with 10–13 lateral bristles in female, 3–5 in male.

Libyastus piger (Jordan, 1925)

Ceratophyllus piger Jordan, 1925, Novit. Zool., 32: 105, figs. 21–22.

Libyastus piger, Jordan, 1936, Novit. Zool., 40: 90. Hopkins, 1947, Uganda Jour., Sci. Suppl., 11: 153, figs. 77, 81.

Libyastus piger is known only from the types; one male and one female found on *Funisciurus* species, Uganda, Mabira Forest.

This species differs from the other members of Section A in several particulars. Although generally it is not so hirsute a form as the other species of this group, it has a fairly well developed median occipital bristle in both sexes. The female is easily separable from other Section A females by the shape of the seventh sternum, both upper and lower lobes being very broadly rounded, the lower projecting farther posteriorly, and the sinus is a long shallow concavity. Laterally, both sides together, the seventh sternum bears only 14 bristles, the other species having about 24 bristles. Cribriform area of spermatheca small, juncture with bulga (body) at an angle of about 120° to ventral margin of bulga, no dorsal hump on bulga; hilla (tail) shorter than bulga. Eighth tergum much as in *infestus*, with mesal small spiniform (genital) bristles not set in a row, but with apical bristles set very widely apart. Anal stylet only about 2 times as long as wide.

A small species; male 2.8 mm., female 3.1 mm. In both sexes the profemur lacks external lateral bristles, and the basal abdominal sternum has only a few lateral bristles.

Libyastus selindae de Meillon, 1940

(figs. 6, 9, 11)

Libyastus infestus selindae de Meillon, 1940, Proc. Roy. Ent. Soc. Lond., Ser. B, 9: 146, figs. 3–4.

Libyastus selindae, Berteaux, 1947, Rev. Zool. Bot. Africa, 40: 102.

Selindae was described from two males, one female off *Paraxerus palliatus swinnertoni*, Mt. Selindae, South Rhodesia, and one male, two females from a squirrel, Chirinda Forest, South Rhodesia. The following paratypes in the British Museum (Natural History)

have been examined: one male, one female from Mt. Selindae and one female from Chirinda Forest.

The female of *selindae* may be distinguished by having the seventh sternum outline (fig. 6) with the upper lobe narrowly rounded, much as in *duratus*, but with the lower lobe broadly rounded, not so acutely as in *duratus*. Laterally the seventh sternum bears about 24 bristles on a side. Hilla (tail) of spermatheca longer than bulga (body), minus the cribriform area (fig. 6), cribriform area much as in *infestus*, joined to bulga obliquely, and hilla with apical papilla-like sclerotization as in *infestus*. Anal stylet (fig. 11) $3\frac{1}{4}$ to $3\frac{1}{2}$ times as long as broad, not markedly narrowed from base to apex, lateral bristle set well back from apex, as in *duratus*. Eighth tergum (fig. 9) with 3-4 small mesal spiniform (genital) bristles set in a straight line (one female with triangulate pattern on one side); the two apical bristles set some distance apart. With three antesensilial bristles.

A fairly large species; male 3.2-3.8 mm., female 4.2-4.8 mm. Both sexes with a small median occipital bristle; basal abdominal sternum with 7-15 lateral bristles in female and 2-4 in male examined. Both sexes lacking lateral external bristles on profemur and with but 1 mesal lateral internal bristle.

CHANGE IN EDITORSHIP OF THE BULLETIN

Effective with this issue, Dr. John F. Hanson of the University of Massachusetts has assumed the editorship of the **Bulletin**. All manuscripts and communications pertaining to manuscripts, short articles and notes should be addressed to

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